



# Hazardous Materials Technical Center

AD-A210 472

INSTALLATION RESTORATION PROGRAM

PRELIMINARY ASSESSMENT

CANYON CREEK RADIO RELAY STATION, ALASKA



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JUL 24 1989  
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Submitted to:

HQ AAC/DEPV  
Elmendorf AFB, AK 99506

Submitted by:

Hazardous Materials Technical Center  
The Dynamac Building  
11140 Rockville Pike  
Rockville, MD 20852

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## EXECUTIVE SUMMARY

### A. Introduction

The Hazardous Materials Technical Center (HMTc) was retained in January 1988 to conduct the Installation Restoration Program (IRP) Preliminary Assessment of the Canyon Creek Radio Relay Station (RRS), Alaska, under Contract No. DLA-900-82-C-4426 with funds provided by the Alaskan Air Command (AAC).

Department of Defense (DoD) policy was directed by Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5 dated 11 December 1981, and implemented by Air Force message dated 21 January 1982, as a positive action to ensure compliance of Air Force installations with existing environmental regulations. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DoD policy is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations.

To implement the DoD policy, a four-phased IRP has been directed consisting of:

- Preliminary Assessment (PA) - to identify past spill or disposal sites posing a potential and/or actual hazard to public health or the environment;
- Site Investigation/Remedial Investigation/Feasibility Study (SI/RI/FS) - to acquire data via field studies, for the confirmation and quantification of environmental contamination that may have an adverse impact on public health or the environment and to select a remedial action through preparation of a feasibility study;
- Research, Development, and Demonstration (RD & D) - if needed, to develop new technology for accomplishment of remediation; and
- Remedial Design/Remedial Action (RD/RA) - to prepare designs and specifications and to implement site remedial action.

The Canyon Creek RRS Preliminary Assessment included:

- an onsite visit, including interviews with six AAC personnel, conducted by HMTC personnel during 12 July through 21 July 1988;
- the acquisition and analysis of pertinent information and records on hazardous material use and hazardous waste generation and disposal at the installation; and
- the acquisition and analysis of available geological, hydrological, meteorological, and environmental data from pertinent Federal, State, and local agencies.

## B. Major Findings

Past installation operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. The major operations of the installation that used and disposed of hazardous materials/hazardous wastes (HM/HW) included management of diesel fuel used to power the generators, management of lead-acid and nickel-cadmium batteries, handling of electrical equipment possibly containing polychlorinated biphenyls (PCBs), and use of asbestos as a construction material.

## C. Conclusions

Information obtained through interviews, records, and field observations resulted in the identification of no sites at Canyon Creek RRS that are potentially contaminated with HM/HW. Small quantities of hazardous materials were used at the RRS while the facility was in operation. The underground diesel tanks at the facility were drained and properly abandoned in place and the batteries and electrical equipment were removed from the site. No evidence of contamination was visible at the time of the site visit. However, asbestos may remain within the radio relay building.

#### D. Recommendations

Because the hazardous materials (electrical equipment, batteries, and fuels) at Canyon Creek RRS have been removed, the underground tanks properly abandoned, and no visible signs of contamination are evident, no further IRP investigation is recommended for the facility. Abatement of any asbestos remaining within the radio relay building is recommended.

## 1. INTRODUCTION

### A. Background

The United States Air Force, due to its primary mission, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, State, and local governments have developed strict regulations to require that disposers of hazardous materials/hazardous wastes (HM/HW) identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The current Department of Defense (DoD) Installation Restoration Program (IRP) policy was directed by Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5 dated 11 December 1981, and implemented by Air Force message dated 21 January 1982, as a positive action to ensure compliance of military installations with existing environmental regulations. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DoD policy is to identify and fully evaluate suspected problems associated with past HM/HW disposal sites on DoD facilities, to control the migration of hazardous contamination, and to control hazards to health and welfare that may have resulted from these past operations. The IRP is a basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and the Superfund Amendments and Reauthorization Act (SARA) of 1986.

To conduct the IRP Preliminary Assessment for Canyon Creek Radio Relay Station (RRS), the Headquarters Alaskan Air Command/Directorate of Programs and Environmental Planning (HQ AAC/DEPV) retained the Hazardous Materials Technical Center (HMTTC) (operated by Dynamac Corporation) in January 1988 under Contract No. DLA-900-82-C-4426.

The Preliminary Assessment comprises the first phase of the DoD IRP and is intended to review installation records to identify possible hazardous waste-contaminated sites and to assess the potential for contaminant migration



from the installation. The Site Investigation (not part of this contract) consists of follow-on field work as determined from the Preliminary Assessment. The Site Investigation includes a preliminary monitoring survey to confirm the presence or absence of contaminants. Upon confirmation of contamination, additional field work is implemented under a Remedial Investigation (not part of this contract) to determine the extent and magnitude of the contaminant migration and provide data necessary for determining appropriate remedial actions, which are evaluated during the Feasibility Study (not part of this contract). Research, Development, and Demonstration (not part of this contract) consists of a technology base development study to support the development of project plans for controlling migration or restoring the installation. Remedial Design/Remedial Action (not part of this contract) includes those activities which are required to control contaminant migration or restore the installation.

#### **B. Authority**

The identification of hazardous waste disposal sites at Air Force installations was directed by Defense Environmental Quality Program Policy Memorandum 81-5 (DEQPPM 81-5) dated 11 December 1981, and implemented by Air Force message dated 21 January 1982, as a positive action to ensure compliance of Air Force installations with existing environmental regulations.

#### **C. Purpose of the Preliminary Assessment**

DoD policy is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites and spill sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health or welfare that may have resulted from these past operations. HMTC evaluated the existence and potential for migration of HM/HW contaminants at Canyon Creek RRS by visiting the installation; reviewing existing installation records concerning the use, generation and disposal of HM/HW; reviewing available environmental information; and conducting interviews with

present Air Force personnel who are familiar with past hazardous materials management activities at the installation.

A physical inspection was made of the various facilities and of the suspected sites. Relevant information collected and analyzed as a part of the Preliminary Assessment included the history of the installation, with special emphasis on the history of past operations and their past HM/HW management procedures; local geological, hydrological, and meteorological conditions that may affect migration of contaminants; local land use that could affect the potential for exposure to contaminants; and the ecological settings that indicate environmentally sensitive habitats or evidence of environmental stress.

#### D. Scope

The Preliminary Assessment program included a pre-performance meeting, an onsite installation visit, a review and analysis of the information obtained, and preparation of this report.

The pre-performance meeting was held at HQ AAC/DEPV, Elmendorf Air Force Base (AFB), Alaska, on 12 July 1988. Attendees at this meeting included representatives of HQ AAC/DEPV and HMTTC. The purpose of the pre-performance meeting was to provide detailed project instructions, clarification, and technical guidance by AAC, and to define the responsibilities of all parties participating in the Canyon Creek RRS Preliminary Assessment.

The scope of this Preliminary Assessment is limited to the installation and includes:

- An onsite visit;
- The acquisition of pertinent information and records on hazardous materials use and hazardous wastes generation and disposal practices at the installation;
- The acquisition of available geological, hydrological, meteorological, land use, and critical habitat data from various Federal, State and local agencies;

- A review and analysis of all information obtained; and
- The preparation of a report to include recommendations for further actions, if warranted.

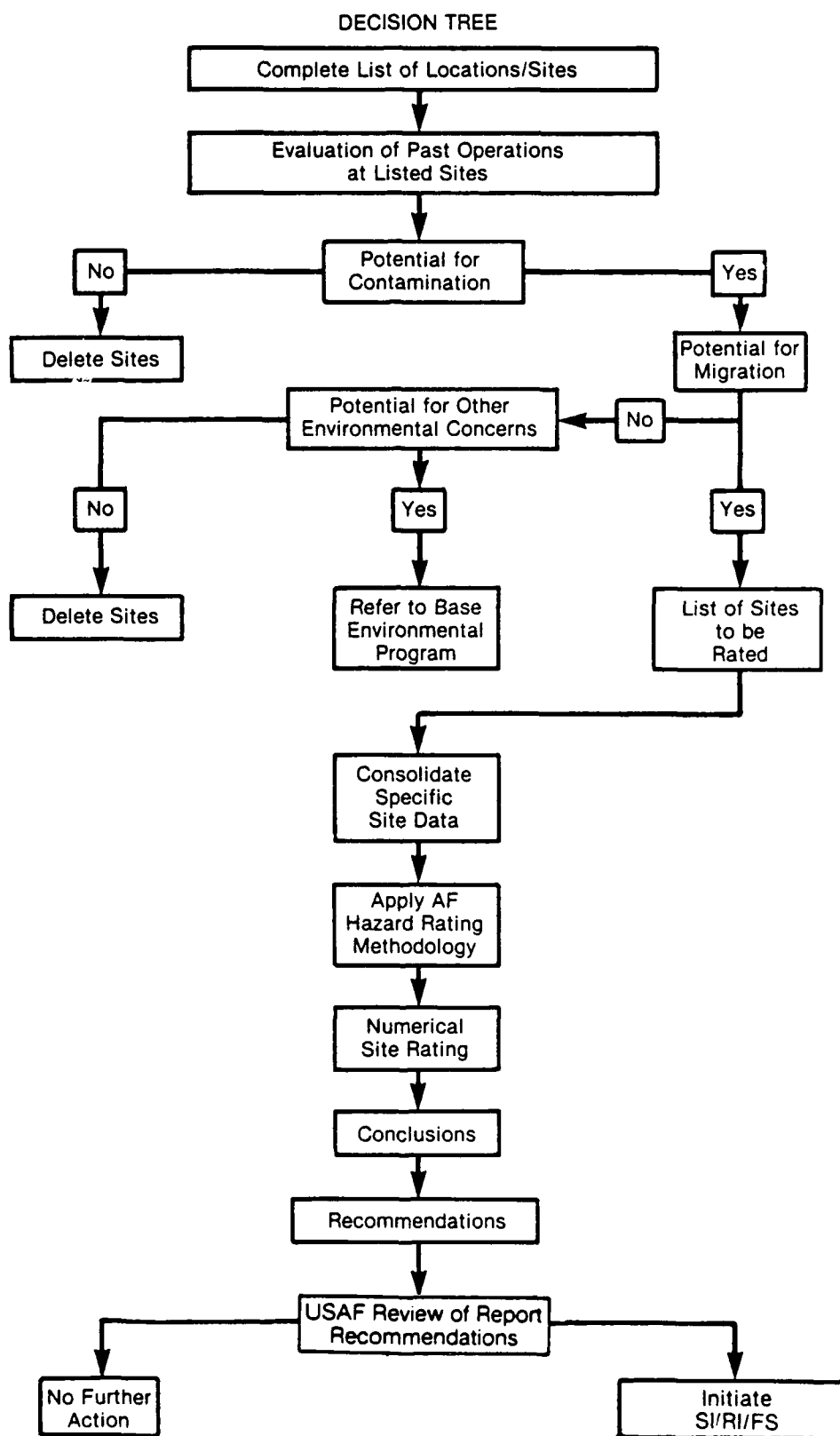
The onsite visit, records search, and interviews with Air Force personnel were conducted during the period 12 to 21 July 1988. The Preliminary Assessment site visit was conducted by Ms. Janet Emry, Hydrogeologist/Project Manager; Mr. Mark Johnson, P.G./Program Manager; Ms. Kathryn Gladden, Chemical Engineer; and Dr. Naichia Yeh, Environmental Scientist. (Appendix A). Other HMTc personnel who assisted in the Preliminary Assessment included Mr. Raymond G. Clark, Jr., P.E./Department Manager. Personnel from AAC who assisted in the Preliminary Assessment included Mr. James W. Hostman, Chief, Environmental Planning HQ AAC/DEPV and Mr. Jeffrey M. Ayres, the Point of Contact (POC) at HQ AAC/DEPV.

#### E. Methodology

A flow chart of the Preliminary Assessment Methodology is presented in Figure 1. This Preliminary Assessment methodology ensures a comprehensive collection and review of pertinent site specific information, and is used in the identification and assessment of potentially contaminated hazardous waste spill/disposal sites.

The Preliminary Assessment begins with a site visit to the installation to identify all potential areas where contamination may have resulted from the use or disposal of HM/HW. Next, an evaluation of past HM/HW handling procedures at the identified locations is made to determine whether environmental contamination may have occurred. The evaluation of past HM/HW handling practices is facilitated by extensive interviews with Air Force personnel familiar with the various past operating procedures at the installation. The interviews also define the areas on the installation where any waste materials, either intentionally or inadvertently, may have been used, spilled, stored, disposed of, or released into the environment.

Preliminary Assessment Methodology Flow Chart.



Historical records are collected and reviewed to supplement the information obtained from interviews. Using the information outlined above, a list of past waste spill/disposal sites on the installation is identified for further evaluation. A general survey tour of the identified spill/disposal sites, the installation, and the surrounding area is conducted to determine the presence of visible contamination and to help assess the potential for contaminant migration. Particular attention is given to locating nearby drainage ditches, surface water bodies, residences, and wells where they are present.

Detailed geological, hydrological, meteorological, land use, and environmental data for the area of study is also obtained from the POC and from appropriate Federal, State, and local agencies. A list of outside agencies contacted is in Appendix B. Following a detailed analysis of all the information obtained, sites are identified as suspect areas where HM/HW disposal may have occurred. Evidence at these sites suggests that they may be contaminated and that the potential for contaminant migration exists. Where sufficient information is available, sites are assigned a Hazard Assessment Score (HAS) using the U.S. Air Force Hazard Assessment Rating Methodology (HARM) and the HARM guidelines (Appendix C). However, the absence of a HAS does not necessarily negate a recommendation for further IRP investigation, but rather may indicate a lack of data.

## II. INSTALLATION DESCRIPTION

### A. Location

Canyon Creek RRS is located within the Fairbanks-North Star Borough, approximately 50 miles south of Fairbanks, just off the Richardson Highway at milepost 302. The RRS is located in a remote area approximately 1.7 miles north of the Tanana River and approximately 2.8 miles east of Birch Lake. Canyon Creek is located 4,500 feet northeast of the RRS. Specifically, the RRS is located in Section 15, Township 7 South, Range 6 East, Fairbanks Meridian. Figure 2 shows the location of Canyon Creek RRS.

The closest residence is located by the Richardson Highway, approximately 1.8 miles west of Canyon Creek RRS. Residential population is calculated by counting the residential housing on the USGS topographic map (Figure 2) and assuming each dwelling has 3.8 residents (47 FR 31233). The total residential population within a 3 mile radius of the RRS, therefore, is 26.

The RRS consists of a communications site (approximately 2.5 acres in size) and an access road (38.7 acres). The communications site consists of one 1,600-square-foot radio relay building and one microwave tower enclosed by a chain link fence. A 20-kilowatt diesel generator and 300-gallon per day tank inside the building originally provided the power needed to run the facility. Two steel underground storage tanks are located on the west side of the site: a 4,000-gallon diesel tank and a 1,000-gallon diesel tank. Figure 3 is a site map of Canyon Creek RRS.

### B. History

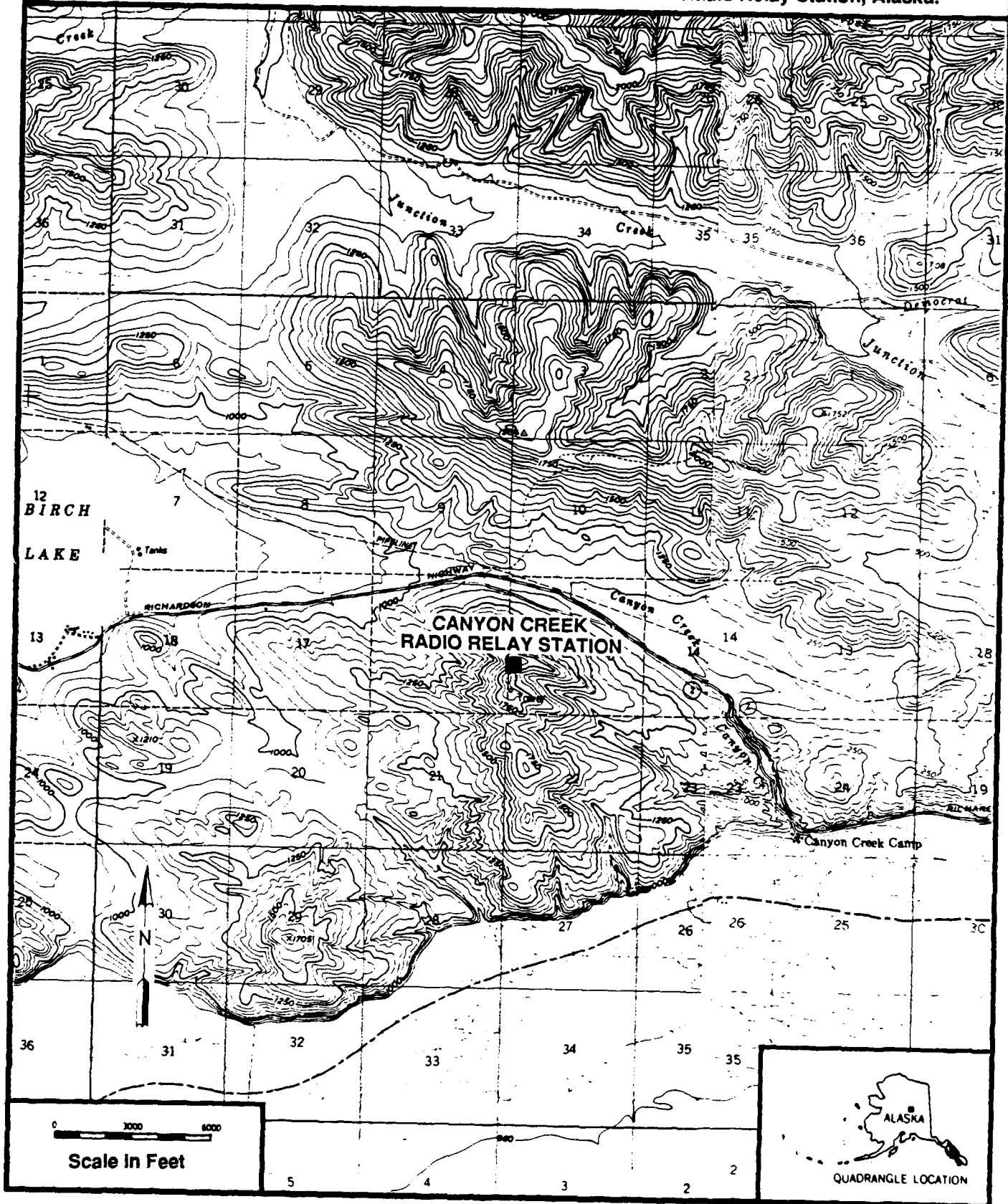
Canyon Creek RRS was constructed in 1959 as part of the Ballistic Missile Early Warning Systems (BMEWS) of the White Alice Communications System (WACS). BMEWS linked Clear AFB to the North American Air Defense (NORAD) headquarters in Colorado. Canyon Creek RRS was part of the BMEWS "B route," which went east

HMTC

Source: U.S.G.S. Big Delta  
(B-5 and B-6) Quadrangle, Alaska  
7.5 Minute Series Topographic Map, 1975 and 1987.

Figure 2.

Location Map of Canyon Creek  
Radio Relay Station, Alaska.

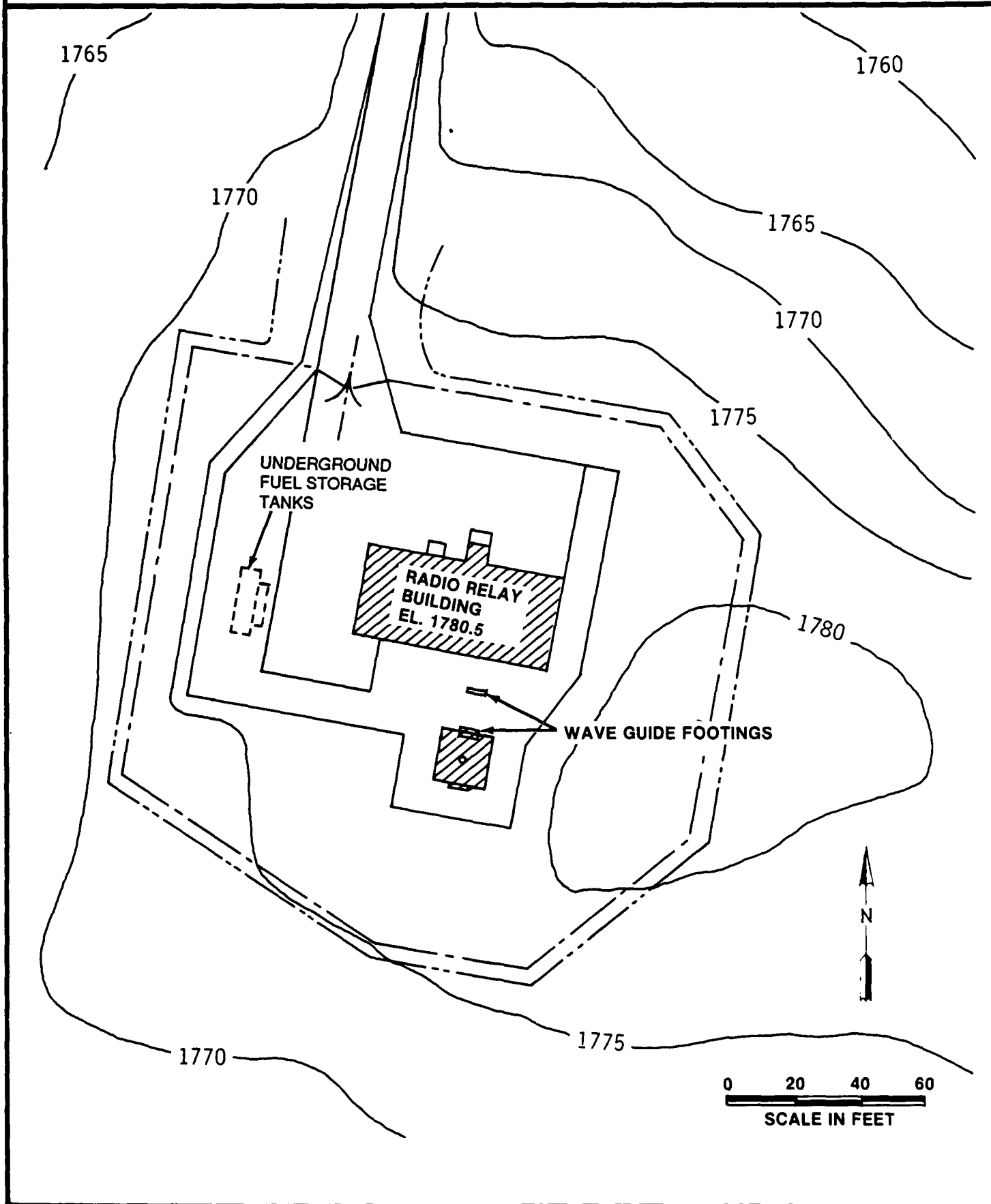


HMTC

Source: U.S. Army Engineer  
District, Alaska, Ladd  
Air Force Base, Alaska  
Drawing AW-11-01-1016, 1960.

Figure 3.

Site Map of Canyon Creek  
Radio Relay Station, Alaska.





from Clear AFB into Canada and then south to NORAD. The RRS was an unattended TD-2 two-way microwave repeater station, which served as a relay between Gold King Creek RRS and Delta Junction RRS. The RRS was leased from the Air Force by RCA Alascom in 1976. The WACS was phased out as its function was replaced by satellite earth stations and commercial long-distance carriers. Canyon Creek RRS was closed on 29 March 1982 (Reynolds, 1988).

According to records of the 5099th Civil Engineering Operations Squadron (CEOS), Canyon Creek RRS was inspected by the Air Force on the day the facility closed. Inside the fence were 10 waste oil drums and within the building were 172 lead-acid batteries (drained), ranging in size from 10 to 1100 lbs. No materials containing polychlorinated biphenyls (PCBs) were found at the RRS (Hostetter, 1984).

In 1985, Canyon Creek RRS was inspected for asbestos and other hazardous wastes. Designs and specifications for asbestos abatement and demolition of the RRS were developed (HMTc, 1986). At that time, the RRS was overgrown with brush, but there were no visible signs of contamination at the facility. Two underground storage tanks containing residual diesel fuel were present on the west side of the site. The only observed health and safety concern were the banks of large batteries inside the building. High-voltage capacitors, fuses, and other electronic components were also observed. It was unknown if these items contained PCBs (Lipsky, 1985).

In September 1987, the 5099th CEOS removed all remaining hazardous materials (except asbestos within the building) from Canyon Creek RRS as part of the Alaska Cleanup Effort (ACE). Turned into the Defense Reutilization and Marketing Office (DRMO) at Fort Wainwright were:

- 29 Nickel-cadmium batteries (drained);
- 129 Lead-acid batteries (drained);
- 29 small, sealed transformers;
- 84 small, sealed capacitors; and
- 16 small, sealed relays.

The two underground storage tanks were excavated and drained of approximately 200 gallons of diesel fuel. The tanks were then cut open, filled with soil and water, and abandoned in place. It is not known if a site assessment was performed in conjunction with the closure of these tanks. The brush was cleared and buried on site. The generator and day tank were removed by the 5099th CEOS for field usage. The building, tower, and chain link fence were left intact.

The cleanup operations at Canyon Creek RRS were documented in a "Finding of No Significant Contamination" and a "PCB Clearance Certificate." Copies of these documents are included in Appendix D.

### III. ENVIRONMENTAL SETTING

#### A. Meteorology

Canyon Creek RRS has a continental climate typical of the Interior Basin of Alaska. This climate is characterized by extreme seasonal variations in temperature and by low total precipitation. Temperature extremes in the area range from 95°F in summer to 63°F below zero in winter. Annual precipitation averages 13 inches, with over half of the total annual rainfall occurring in June, July, and August (Schoephorster 1973). Maximum rainfall intensity in the Canyon Creek area, based on a 10-year, 24-hour rainfall, is 2.0 inches (Miller, 1963). Total annual snowfall averages about 40 inches, with snow generally covering the ground from mid-October to mid-April (Schoephorster, 1973). Net precipitation is calculated by subtracting the mean annual lake evaporation from the average annual precipitation (47 FR 31227). Since the mean annual lake evaporation rate is not available for this part of Alaska, the potential evapotranspiration rate was used (NOAA, personal communication, 1988). The potential evapotranspiration rate for the Canyon Creek area is approximately 18 inches per year (Patric and Black, 1986); therefore, the net precipitation is negative 5 inches per year.

#### B. Geology and Soils

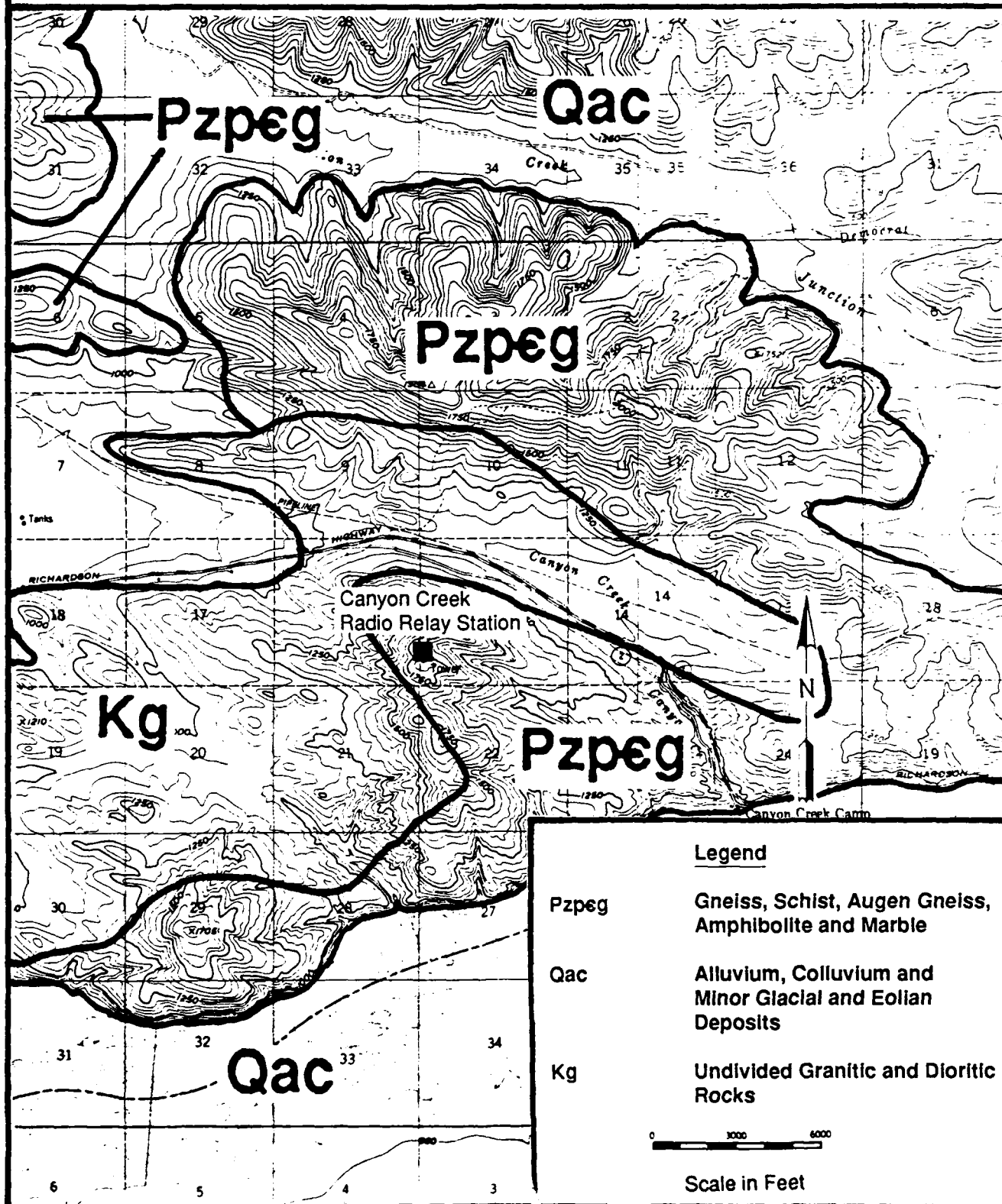
The rounded hills and ridges north of the Tanana River are a part of the unglaciated Yukon-Tanana Upland physiographic province. Bedrock in the area is chiefly the Precambrian Birch Creek Formation, which is composed of quartz sericite schist, quartzite, and carbonaceous schist. A few Cretaceous or Tertiary granite and quartz diorite plutons are also present. The uplands are blanketed by silty micaceous loess derived from the outwash plains south of the Tanana River. The mantle of loess ranges from a few inches to many feet in thickness on most of the hills and ridges. Much of the loess has washed from the slopes and accumulated on foot slopes and in upland valleys (Schoephorster, 1973; Luthy and others, 1981). Canyon Creek RRS is located within the Yukon-

Figure 4.

HMTC

Source: U.S.G.S  
Open File Report 78-529D, 1978.

Geologic Map of Canyon Creek Radio  
Relay Station, Alaska and Vicinity.



Tanana Upland Province, on a hill overlooking the Tanana River. The RRS is underlain by about 30 inches of micaceous residual soil and weathered bedrock. These are underlain by the Birch Creek schist bedrock.

The geology south of the Tanana River contrasts sharply with the unglaciated area north of the river. Glaciers from the Alaska Range extended into this area during the Pleistocene epoch. As they retreated, large deposits of coarse sandy and gravelly material were laid down by glacial meltwater and broad outwash plains were formed. These plains slope gradually to the north, toward the Tanana River. Just east of Delta Junction is the Delta moraine, characterized by knob-and-kettle topography of low relief. Sand dunes occur on the outwash plains, especially next to flood plains of major streams (Schoephorster, 1973).

According to the U.S. Soil Conservation Service, the soils at the Canyon Creek RRS belong to the Steese series, which are well drained, moderately sloping to steep silt loams that are underlain by bedrock. The soil at the RRS is the Steese silt loam, strongly sloping (12 to 20 percent slopes). This soil type occurs on high ridges and hillsides on slopes that face south, and therefore lack permafrost. The surface layer of the Steese soil is composed of a dark reddish-brown mat of decomposing organic matter and roots about 2 inches thick, underlain by a 4-inch layer of dark brown and brown silt loam. The subsoil is a dark yellowish-brown or olive brown silt loam about 15 inches thick. Weathered schist bedrock extends to a depth of approximately 28 inches, where it grades into solid rock. Permeability of the Steese silt loam is moderate ( $5.64 \times 10^{-4}$  to  $1.76 \times 10^{-3}$  cm/sec). Runoff is medium to rapid on cleared areas, and the hazard of water erosion is severe (Schoephorster, 1973).

## C. Hydrology

### Surface Water

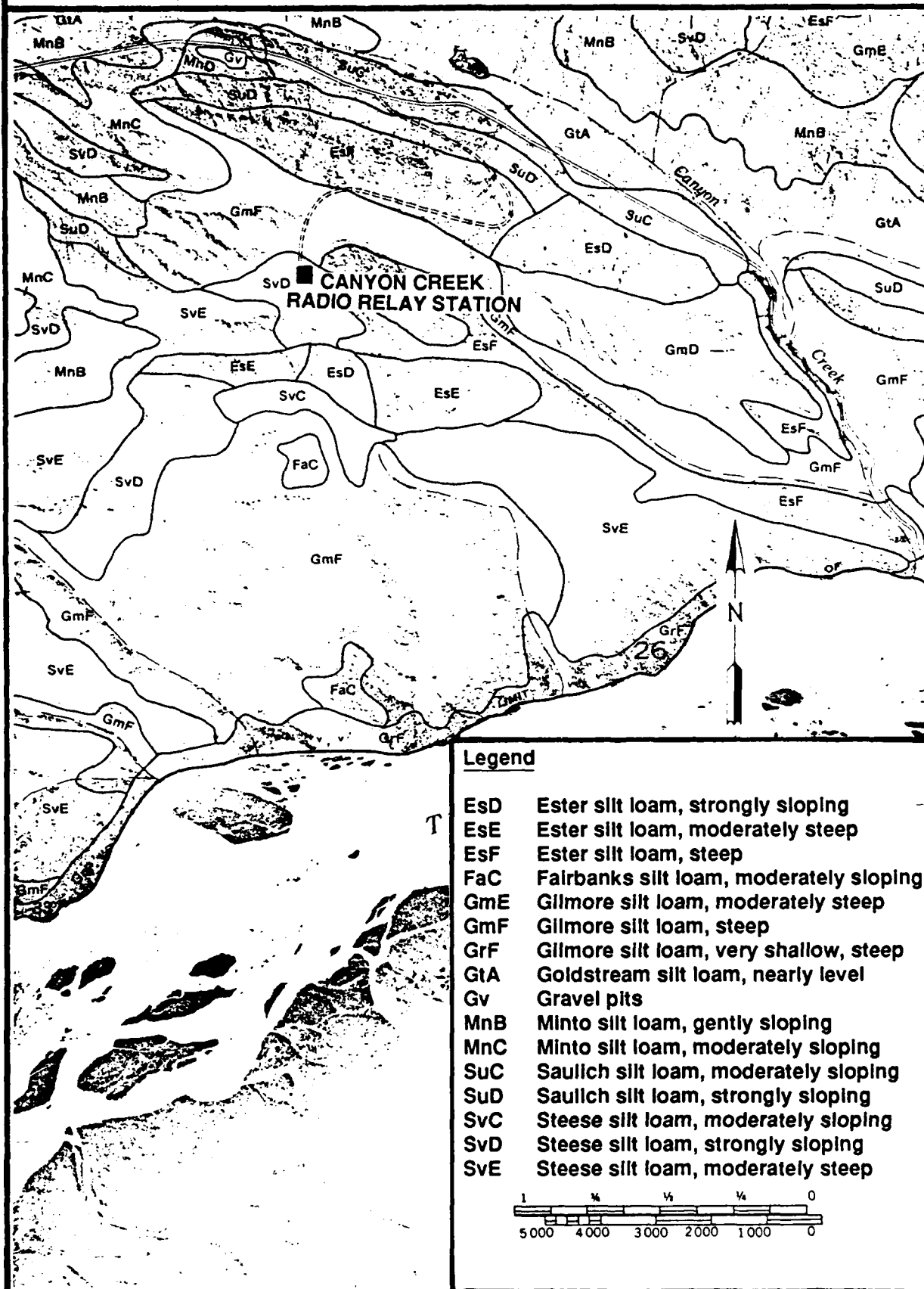
The area around Canyon Creek RRS is drained by the Tanana River and its tributaries. Streams that drain the unglaciated uplands, such as Canyon Creek,

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U.S.D.A.,  
Soil Conservation Service,  
Soil Survey for Salcha-Big Delta  
Area, Alaska, 1973.

**Figure 5.**

**Soils Map of Canyon Creek Radio  
Relay Station, Alaska and Vicinity.**



are relatively clear; the Tanana River and its major tributaries that flow from the mountains in the south are glacier fed and heavily laden with silt and sand (Schoephorster, 1973). Based on elevation, the RRS is above the 100-year flood plain of the Tanana River.

Surface runoff at the Canyon Creek RRS drains off the site to the north, west, and south. Northward-draining runoff flows into Canyon Creek and the Tanana River. Runoff draining to the south and west flows into small creeks tributary to Birch Lake and the Tanana River. Birch Lake, which is located approximately 2.8 miles west of the RRS, is a recreation area.

#### Groundwater

Specific groundwater data for the Canyon Creek RRS area is not available; however, some general assumptions can be made based on the nature of the soils and geology of the region. Shallow groundwater at Canyon Creek RRS, if any, would occur within the soil and weathered schist bedrock, at a depth of less than 30 inches. As Canyon Creek RRS is situated on a topographically high area, shallow groundwater would flow from this high in all directions toward lower elevations, mimicking surface water flow.

Groundwater may also be found in joints, fractures, and shear zones within the schist bedrock. Joints generally occur in the uppermost 300 feet, while fractures associated with faulting can occur at any depth. In general, groundwater yield from wells in metamorphic rock decreases rapidly with depth (Fetter, 1980).

#### **D. Critical Habitats/Endangered or Threatened Species**

According to the U.S. Fish and Wildlife Service, Alaska Division, there are no endangered or threatened species within a 1-mile radius of the Canyon Creek RRS. Within 10 miles of the RRS, however, are four historical American peregrine falcon eyries. The American peregrine falcon is a federally-listed endangered

species. One eyrie is located within 3 miles of the RRS. Three of the eyries were active in 1988.

According to the National Wetland Inventory (1985), there are several wetland areas within a 1-mile radius of the RRS. Along drainageways into Birch Lake west of Canyon Creek RRS are wetland areas with needle-leaved evergreen scrub and shrub. Along Canyon Creek northeast of the RRS are wetland areas with needle-leaved evergreen and broad-leaved deciduous forests. South of the RRS are broad-leaved deciduous scrub and shrub wetlands along the Tanana River.

No federally- or state-designated critical habitats or wilderness areas are located within a 1-mile radius of the RRS.



## **IV. FINDINGS**

### **A. Activity Review**

A review of AAC records and interviews with Air Force personnel resulted in the identification of specific operations at Canyon Creek RRS in which the majority of HM/HW were handled or generated. These operations include:

- Management of diesel fuel used to power the generators;
- Management of electrical equipment possibly containing PCBS;
- Management of lead-acid and nickel-cadmium batteries used to store electricity; and
- Usage of asbestos as a construction material.

### **B. Disposal/Spill Site Identification, Evaluation, and Hazard Assessment**

Interviews with Air Force personnel and subsequent site inspections resulted in the identification of no potentially contaminated sites at Canyon Creek RRS. Although no sites were identified or assigned a HAS according to HARM, the methodology and guidelines are included as Appendix C. The objective of this assessment is to identify and provide a relative ranking of sites suspected of contamination from hazardous substances. The final rating score would reflect specific components of the hazard posed by a specific site: possible receptors of the contamination (e.g., population within a specified distance of the site and/or critical environments within a one-mile radius of the site); the waste and its characteristics; and the potential pathways for contaminant migration (e.g., surface water, groundwater, flooding).

### **C. Other Pertinent Information**

At the time of the site visit to Canyon Creek RRS on 13 July 1988, the following observations were made:

- The area within the fence appeared to have been recently cleared and graded (see Photos 1 and 2, Appendix E);
- No stained soil, abandoned drums, or landfills were observed;
- A portion of a steel underground tank was exposed at the land surface to the west of the radio relay building. While digging in the soil to expose more of the tank, readings were taken with a photoionization detector (PID). No organic volatiles were detected by the PID (see Photos 3 and 4, Appendix E);
- The outside perimeter of the facility was also inspected and no visible signs of contamination were found; and
- The radio relay building was not inspected, as it was locked. Asbestos may remain within the building.

## V. CONCLUSIONS

Based on information obtained through interviews with Air Force personnel and review of installation records, small quantities of hazardous materials were handled at Canyon Creek RRS while the facility was operational. Underground storage tanks containing diesel fuel were present at the facility, as were batteries and electrical equipment possibly containing PCBs.

The underground tanks have been drained and abandoned in place. The batteries and electrical equipment were removed from the building and sent to the DRMO at Fort Wainwright. At the time of the site visit, there was no visible evidence of contamination (i.e. stained soil, abandoned drums, or landfills) at the facility. The only health and safety concern at Canyon Creek RRS is asbestos that may remain within the radio relay building.

## VI. RECOMMENDATIONS

The small quantities of hazardous materials at Canyon Creek RRS have been removed and the underground tanks have been drained and abandoned in place. At the time of the site visit, no visible signs of contamination were evident at the facility. As a result, no further IRP investigation is recommended for the facility. However, the Air Force should proceed with abatement of any asbestos remaining within the radio relay building.

## GLOSSARY OF TERMS

ANNUAL PRECIPITATION - The total amount of rainfall and snowfall for the year.

ASBESTOS - A group of silicate minerals that readily form into thin, strong fibers that are flexible, heat resistant, and chemically inert; used commercially in construction.

BEDROCK - A general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.

CARBONACEOUS - Said of a rock or sediment that is rich in carbon.

CONTAMINANT - As defined by Section 101(f)(33) of Superfund Amendments and Reauthorization Act of 1986 (SARA) shall include, but not be limited to any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformation in such organisms or their offspring; except that the term "contaminant" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under:

- (a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,
- (b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,
- (c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress),
- (d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,
- (e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and
- (f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substance Control Act;

and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

CONTINENTAL CLIMATE - The climate of the interior of a continent, characterized by seasonal temperature extremes and by the occurrence of maximum and minimum temperature soon after summer and winter solstice, respectively.

CREEK - A term generally applied to any natural stream of water, normally larger than a brook but smaller than a river.

CRETACEOUS - The final period of the Mesozoic era, thought to have covered the span of time between 135 and 65 million years ago.

CRITICAL HABITAT [Fed] - The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management consideration or protection; and specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act, upon a determination by the Secretary that such areas are essential for the conservation of the species.

CRITICAL HABITAT [Alaska] - Places where protective emphasis is on the environment in which wildlife occurs. Critical habitats may be complete biotic systems -- identifiable environmental units that operate as self-sustaining systems -- or well-defined areas specifically needed by wildlife for certain functions such as nesting or spawning.

DECIDUOUS - Having foliage that sheds at specific seasons; distinguished from evergreen.

DEPOSITS - Earth material of any type, either consolidated or unconsolidated, that has accumulated by some natural process or agent.

DRAINAGE CLASS [natural] - Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

*Excessively drained* - Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

*Somewhat excessively drained* - Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

*Well drained* - Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

*Moderately well drained* - Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during

the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

*Somewhat poorly drained* - Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

*Poorly drained* - Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough periods during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

*Very poorly drained* - Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

**ENDANGERED SPECIES** - Any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of the Endangered Species Act would present an overwhelming and overriding risk to man.

**EVERGREEN** - Having foliage that remains green until the formation of new foliage; distinguished from deciduous.

**EYRIE** - The nest of a predatory bird, situated on a height.

**FLOOD PLAIN** - The surface or strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks.

**FOREST** - A tract of land covered with a growth of trees and underbrush.

**FORMATION** - A lithologically distinctive, mappable body of rock.

**FRACTURE** - A general term for any break in a rock, whether or not it causes displacement, due to mechanical failure by stress. Fracture includes cracks, joints, and faults.

**GLACIAL** - (a) Of or relating to the presence and activities of ice or glaciers, (b) Pertaining to distinctive features and materials produced or derived from glaciers and ice sheets.

**GRANITE** - Broadly applied, any crystalline, quartz-bearing plutonic rock; also commonly contains feldspar, mica, hornblende, or pyroxene.

**GROUNDWATER** - Refers to the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

**HARM** - Hazard Assessment Rating Methodology - A system adopted and used by the United States Air Force to develop and maintain a priority listing of potentially contaminated sites on installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts. (Reference: DEQPPM 81-5, 11 December 1981.)

**HAS** - Hazard Assessment Score - The score developed by using the Hazardous Assessment Rating Methodology (HARM).

**HAZARDOUS MATERIAL** - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions also found in OSHA and DOT rules.

**HAZARDOUS WASTE** - A solid or liquid waste that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

- a. cause, or significantly contribute to, an increase in mortality or an increase in serious or incapacitating reversible illness, or
- b. pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

**HILL** - A natural elevation of the land surface, rising rather prominently above the surrounding land, usually of limited extent and having a well defined outline (rounded) and generally considered to be less than 1,000 feet from base to summit.

**JOINT** - A surface of fracture or parting in a rock, without displacement.

**KNOB-AND-KETTLE TOPOGRAPHY** - An undulating landscape in which a disordered assemblage of knolls, mounds, or ridges of glacial drift is interspersed with irregular depressions, pits, or kettles that are commonly undrained and may contain swamps or ponds.

**LOAM** - A rich, permeable soil composed of a friable mixture of relatively equal proportions of sand, silt, and clay particles, and usually containing organic matter.

**LOESS** - A widespread, homogeneous, commonly nonstratified, porous, friable, slightly coherent, usually highly calcareous, fine-grained blanket deposit (generally less than 30 inches thick).

**MELTWATER** - Water derived from the melting of snow or ice, especially the stream flowing in, under, or from melting glacier ice.



MICACEOUS - Consisting of, containing, or pertaining to mica.

MORAINE - A mound, ridge, or other distinct accumulation of unsorted, unstratified glacial drift, predominantly till, deposited chiefly by direct action of glacier ice, in a variety of topographic landforms that are independent of control by the surface on which the drift lies.

NATURAL AREA - An area of land or water that has retained its wilderness character, although not necessarily completely natural and undisturbed, or that has rare or vanishing flora, fauna, archaeological, scenic, historical, or similar features of scientific or educational value.

OUTWASH [glac geol] - A stratified detritus (chiefly sand and gravel) removed or "washed out" from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of an active glacier.

OUTWASH PLAIN - A broad, gently sloping sheet of outwash deposited by meltwater streams flowing in front of or beyond a glacier, and formed by coalescing outwash fans.

PARK - An area of public land known for its natural scenery and preserved for public recreation by a State or national government.

PEREGRINE FALCON - Any of genus (Falco) of diurnal birds of prey noted for their powerful wings, keen vision, and swiftness of attack upon their quarry; generally blackish blue above and white or gray below, formerly much used in falconry.

PERMAFROST - Rock or soil material that has remained below 0°C continuously for two or more years. Permafrost is defined solely on the basis of temperature.

PHYSIOGRAPHIC PROVINCE - Region of similar structure and climate that has had a unified geomorphic history.

PLEISTOCENE - The first epoch of the Quaternary period; the Pleistocene began two to three million years ago and lasted until the start of the Holocene period some 8,000 years ago.

PLUTON - An igneous intrusion.

PRESERVE - An area maintained and protected especially for regulated hunting and fishing.

PRISTINE - Something that is still pure or untouched; uncorrupted; unspoiled.

QUARTZ - A crystalline silica, an important rock forming mineral:  $\text{SiO}_2$ . Occurs either in transparent hexagonal crystals (colorless or colored by impurities) or in crystalline. Forms the major proportion of most sands and has a widespread distribution in igneous, metamorphic and sedimentary rocks.

QUARTZ DIORITE - A group of plutonic rocks having the composition of diorite, but with quartz making up 5 to 20% of the light-colored constituents.

QUARTZITE [meta] - A granoblastic metamorphic rock consisting mainly of quartz and formed by recrystallization of sandstone or chert by either regional or thermal metamorphism.

RECHARGE AREA - An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers.

RESIDUAL SOIL - A soil developed by the weathering of rock in place.

RIDGE - A general term for a long, narrow elevation of the Earth's surface, usually sharp-crested with steep sides, occurring either independently or as part of a larger mountain or hill.

SAND - A rock or mineral particle in the soil, having a diameter in the range 0.52 - 2 mm.

SAND DUNE - An accumulation of sand heaped up by the wind, commonly found along low-lying seashores above high tide level, more rarely on borders of large lakes or river valleys.

SCHIST - A medium or coarse-grained, strongly foliated, crystalline rock; formed by dynamic metamorphism.

SCRUB - A tract of stunted trees or shrubs.

SERICITE - A white, fine-grained potassium mica found in various metamorphic rocks, especially in schists and gneisses.

SHEAR ZONE - A tabular zone of rock that has been crushed and brecciated by many parallel fractures due to shear strain.

SILT [geol] - A rock fragment or detrital particle smaller than a very fine sand grain and larger than coarse clay, having a diameter in the range of 0.004 to 0.063 mm.

SILT LOAM - A soil containing 50 - 88% silt, 0 - 27% clay and 0 - 50% sand.

SOIL PERMEABILITY - The characteristic of the soil that enables water to move downward through the profile. Permeability is measured as to the number of inches per hour that water moves downward through the saturated soil.

Terms describing permeability are:

Very Slow	- less than 0.06 inches per hour (less than $4.24 \times 10^{-5}$ cm/sec)
Slow	- 0.06 to 0.20 inches per hour ( $4.24 \times 10^{-5}$ to $1.41 \times 10^{-4}$ cm/sec)
Moderately Slow	- 0.20 to 0.63 inches per hour ( $1.41 \times 10^{-4}$ cm/sec to $4.45 \times 10^{-4}$ cm/sec)

Moderate	- 0.63 to 2.00 inches per hour ( $4.45 \times 10^{-4}$ to $1.41 \times 10^{-3}$ cm/sec)
Moderately Rapid	- 2.00 to 6.00 inches per hour ( $1.41 \times 10^{-3}$ to $4.24 \times 10^{-3}$ cm/sec)
Rapid	- 6.00 to 20.00 inches per hour ( $4.24 \times 10^{-3}$ to $1.41 \times 10^{-2}$ cm/sec)
Very Rapid	- more than 20.00 inches per hour (more than $1.41 \times 10^{-2}$ cm/sec)

(Reference: U.S.D.A. Soil Conservation Service)

**SOIL REACTION** - The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests of pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as:

	<u>pH</u>
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

**SOIL STRUCTURE** - The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are -- platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

**SURFACE WATER** - All water exposed at the ground surface, including streams, rivers, ponds, and lakes.

**TERTIARY** - The first period of the Cenozoic era, thought to have covered the span of time between 65 and 3 to 2 million years ago.

**THREATENED SPECIES** - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

**TRIBUTARY** - A stream feeding, joining, or flowing into a larger stream or into a lake.

UPLANDS - A general term for high land or extensive region of high land, in contrast to a valley, plain, or other low-lying land.

VALLEY - Any low-lying land bordered by higher ground, esp. an elongate, relatively large, gently sloping depression of the earth's surface, commonly situated between two mountains or between ranges of hills and mountains, and often containing a stream or river with an outlet. It is usually developed by stream or river erosion, but can be formed by faulting.

WETLANDS [EPA] - Marshes, swamps, bogs, and other low-lying areas, which during some period of the year will be covered in part by natural nonflood waters.

WETLANDS - Are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of the Classification of Wetlands and Deepwater Habitats of the United States, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

WILDERNESS AREA - An area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this chapter of the Wilderness Act, an area of underdeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or an primitive and unconfined type of recreation; (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic or historical value.

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**APPENDIX A**  
**RESUMES OF PRELIMINARY ASSESSMENT TEAM MEMBERS**

## JANET SALYER EMRY

### EDUCATION

M.S., geology, Old Dominion University, 1987

B.S. (cum laude), geology, James Madison University, 1983

### EXPERIENCE

Three years' technical experience in the fields of hydrogeology and environmental science, including drilling and placement of wells, well monitoring, aquifer testing, determination of hydraulic properties, computer modeling of aquifer systems, and field and laboratory soils analysis.

### EMPLOYMENT

Dynamac Corporation (1987-present): Staff Scientist/Hydrogeologist

Responsibilities include Preliminary Assessments, Site Investigations, Remedial Investigations, Feasibility Studies, and Emergency Responses to include providing geological and hydrological assessments of hazardous waste disposal/spill sites, determination of rates and extents of contaminant migration, and computer modeling of groundwater flow and contaminant transport. Projects are for the U.S. Air Force and Air National Guard Installation Restoration Program.

Froehling and Robertson, Inc. (1986-1987): Geologist/Engineering Technician

Performed both field and laboratory engineering soils tests.

The Nature Conservancy (1985-1986): Hydrogeologist

Investigated groundwater geology of the Nature Conservancy's Nags Head Woods Ecological Preserve in Dare County, North Carolina. Study included installing wells, monitoring water table levels, determination of hydraulic parameters through a pumping test, stratigraphic test borings, and computer modeling.

Old Dominion University (1983-1985): Teaching Assistant, Department of Geological Sciences

Taught laboratory classes in Earth Science and Historical Geology.

### PROFESSIONAL AFFILIATIONS

Geological Society of America

National Water Well Association/Association of Ground Water Scientists  
and Engineers



J.S. EMRY  
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PUBLICATION

Impact of Municipal Pumpage Upon a Barrier Island Water Table, Nags Head and Kill Devil Hills, North Carolina. In: Abstracts with Programs, Geological Society of America, Vol. 19, No. 2, February 1987.

## MARK D. JOHNSON

### EDUCATION

B.S., Geology, James Madison University, 1980

### EXPERIENCE

Eight years' technical and management experience including geologic mapping, subsurface investigations, foundation inspections, groundwater monitoring, pumping and observation well installation, geotechnical instrumentation, groundwater assessment, preparation of Air Force Installation Restoration Program Guidance, preparation of statements of work for environmental field monitoring and feasibility studies for the Air Force and the Air National Guard, development of environmental field monitoring programs, and preparation of Preliminary Assessments for the Air National Guard.

### EMPLOYMENT

#### Dynamac Corporation (1984-present): Senior Staff Scientist/Geologist

Primarily responsible for developing and managing technical support programs relevant to CERCLA related activities for the Air Force, Air National Guard, Department of Justice and Coast Guard. These activities include Statements of Work for Site Investigations (SI), Remedial Investigations (RI), and Feasibility Studies (FS); assessing groundwater at hazardous waste disposal/spill sites for the purpose of determining rates and extents of contaminant migration and for developing SI and RI programs and identifying remedial actions; reviewing SI, RI and FS contractor work plans for various government clients, developing technical and contractual requirements for SI, RI and FS projects, managing the development and preparation of Preliminary Assessments, and assisting clients in the development of their environmental management programs, which included preparation of the Air Force's Installation Restoration Program Management Guidance document.

#### Bechtel Associates Professional Corporation (1981-1984): Geologist

Performed the following duties in conjunction with major civil engineering projects including subways, nuclear power plants and buildings: prepared geologic maps of surface and subsurface facilities in rock and soil including tunnels, foundations and vaults; assessed groundwater conditions in connection with construction activities and groundwater control systems; monitored the installation of permanent and temporary dewatering systems and observation wells; monitored surface and subsurface settlement of tunnels; and participated in subsurface investigations.

#### Schnabel Engineering Associates (1981): Geologist

Inspected foundations and backfill placement.

M.D. JOHNSON  
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PROFESSIONAL CREDENTIALS

Registered Professional Geologist, South Carolina, #116, 1987

PROFESSIONAL AFFILIATIONS

Association of Engineering Geologists  
National Water Well Association/Association of Ground Water Scientists  
and Engineers

## KATHRYN A. GLADDEN

### EDUCATION

B.S., chemical engineering (minor in biological sciences), University of Washington, 1978

### SECURITY CLEARANCE

Secret DOD clearance

### EXPERIENCE

Seven years of experience in hazardous waste consulting and plant process engineering. Experience includes development of engineering alternatives for reduction of in-plant effluents and preparation of RCRA background listing documents for the plastics industry.

### EMPLOYMENT

#### Dynamac Corporation (1985-present): Staff Engineer

Performs studies on the feasibility of solvent recycling, including the evaluation of several alternatives. Studies to date have included 15 sites. For each site, prepared reports describing present practice for solvent use and disposal, and conducted economic analyses of options.

Conducted preliminary site investigations and ranking of hazardous waste sites for the U.S. Federal Bureau of Prisons. Prepared reports detailing site investigation findings and recommendations for Phase II monitoring and sampling.

Preparing statement of work for a Phase IV-A remedial action plan for the Air Force's Installation Restoration Program.

Conducted analysis of public comments on Advanced Notice of Public Rulemaking to establish National Primary Drinking Water Regulations for radionuclide contaminants.

#### Peer Consultants (1984-1985): Staff Engineer

Developed background documents for listing of RCRA hazardous wastes.

#### Engineering Science (1983-1984): Staff Engineer

Conducted regulatory policy review and technology assessment of transportation and decontamination procedures for acutely hazardous wastes. Project engineer for development of a cost analysis methodology for the U.S. Army Toxic and Hazardous Materials Agency Installation Restoration Program.

K.A. GLADDEN  
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Weyerhaeuser Company (1978-1983): Chemical Engineer

Conducted plant environmental audits to develop in-plant effluent load balances; developed capital alternatives and improved operating procedures for in-plant effluent reduction; developed and implemented recommendations for plant energy conservation and process optimization programs; investigated industrial hygiene impacts of wood pyrolysis air emissions, and performed pilot trials for wood gasification and pyrolysis technology development.

PROFESSIONAL AFFILIATIONS

Tau Beta Pi Engineering Honorary  
Society of Women Engineers

## NAICHIA YEH

### EDUCATION

Ph.D., Environmental Sciences, The University of Texas at Dallas, 1987  
M.S., Environmental Sciences, The University of Texas at Dallas, 1984  
B.S., Physics, National Taiwan Normal University, 1978

### EXPERIENCE

Nine years of combined academic and technical experience in hazardous waste management and in supplying technology-based solutions to environmental problems, including environmental assessment and evaluation of the nature and the potential environmental impacts of hazardous waste. Has extensive knowledge in computer-aided modeling methodology.

### EMPLOYMENT

#### Dynamac Corporation (1987-present): Environmental Scientist

Conducts preliminary assessments of suspected hazardous materials/hazardous waste sites at military installations in order to identify, and evaluate potentially hazardous waste disposal sites. Also, quantifies contamination at these sites and analyzes the data in order to determine both short-term and long-term public health effect as well as future risks that may result from exposure to the site contaminants.

Provides technical information consultation to clients with inquiries regarding state-of-the-art technology, current regulations and hazards associated with usage of hazardous materials. Also provides guidance on proper transportation and disposal methods of hazardous wastes, safe storage and handling for hazardous materials, and hazards associated with chemicals and substances.

Provides computerized management services support for environmental contracts to the Hazardous Material Management Division of the Dynamac Corporation. Conducts scientific data processing and data analysis, and develops databases for managing work assignments and contracts.

Developed an electronic hazardous assessment rating system which is a fully computerized version of the U.S. Air Force Hazardous Assessment Rating System. Designed a technical inquiry data base system to keep track of the technical inquiry service requests received by the Hazardous Materials Technical Center operated by Dynamac Corporation. Implemented an efficient methodology for preparing the project expense reports to support program management functions.

The University of Texas at Dallas (1985-1987): Research Assistant

Participated in an environmental assessment and design project which involved the evaluation of the nature and potential impact of hazardous waste. This project included the design of field and laboratory programs for the collection of data used with computer-aided modeling, the site assessment of the proposed hazardous waste facilities, the field sampling and hazardous waste characterization, the zoning of polluted site, the design of remedial cleanup program, and the conceptual design of the hazardous waste disposal plan based on the onsite investigation and computer modeling results.

The University of Texas at Dallas (1984-1985): Computer Laboratory Consultant

Instructed students in microcomputer application and computer programming languages. Conducted scientific data processing and data analysis. Developed a regression analysis program with Lotus 1-2-3. The program integrates five regression mechanisms and takes full advantage of Lotus 1-2-3's keyboard macro and graphic abilities.

The University of Texas at Dallas (1983): Teaching Assistant

Taught numerical analysis and applied mathematics in environmental engineering.

Peitou High School (1979, 1982): Science Teacher

Taught physics, mathematics, computer sciences, and environmental education.

ROC Army (1980-1981): Research Scientist

Conducted environmental surveys and evaluations.

HARDWARE

IBM 360/370., IBM 4341, IBM 4381, IBM PC/XT/AT, IBM PS/2 and compatibles, TI Professional, TI 59, TI 990, and Apple computer family

SOFTWARE

Wylber, Music, CMS, SAS, MS-DOS, CP/M, and various PC-based software systems such as Lotus 1-2-3, DBaseIII+, plus different graphics and data communication utilities; languages used include FORTRAN, BASIC, PL/I, and Pascal

## RAYMOND G. CLARK, JR.

### EDUCATION

Completed graduate engineering courses, George Washington University, 1957  
B.S., Mechanical Engineering, University of Maryland, 1949

### SPECIALIZED TRAINING

Grad. European Command Military Assistance School, Stuttgart, 1969  
Grad. Army Psychological Warfare School, Fort Bragg, 1963  
Grad. Sanz School of Languages, D.C., 1963  
Grad. DOD Military Assistance Institute, Arlington, 1963  
Grad. Defense Procurement Management Course, Fort Lee, 1960  
Grad. Engineer Officer's Advanced Course, Fort Belvoir, 1958

### CERTIFICATIONS

Registered Professional Engineer: Kentucky (#4341); Virginia (#8303);  
Florida (#36228)

### EXPERIENCE

Thirty-one years of experience in engineering design, planning and management including construction and construction management, environmental, operations and maintenance, repair and utilities, research and development, electrical, mechanical, master planning and city management. Over six years' logistical experience including planning and programming of military assistance materiel and training for foreign countries, serving as liaison with American private industry, and directing materiel storage activities in an overseas area. Over two years' experience as an engineering instructor. Extensive experience in personnel management, cost reduction programs, and systems improvement.

### EMPLOYMENT

Dynamac Corporation (1986-present): Program Manager/Department Manager

Responsible for activities relating to Preliminary Analysis, Site Investigations, Remedial Investigations, Feasibility Studies, and Remedial Action for the Installation Restoration Program for the U.S. Air Force, Air National Guard, Bureau of Prisons, and the U.S. Coast Guard, including records search, review and evaluation of previous studies; preparation of statements of work, feasibility studies; preparation of remedial action plans, designs and specifications; review of said studies/plans to ensure that they are in conformance with requirements; review of environmental studies and reports; preparation of Air Force Installation Restoration Program Management Guidance; and preparation of Part B permits.



Howard Needles Tammen & Bergendoff (HNTB) (1981-1986): Manager

Responsible, as Project Manager, for: design of a new concourse complex at Miami International Airport to include terminal building, roadway system, aircraft apron, drainage channel relocation, satellite building with underground pedestrian tunnel, and associated underground utility corridors, to include subsurface aircraft fueling systems, with an estimated construction cost of \$163 million; a cargo vehicle tunnel under the crosswind runway with an estimated construction cost of \$15 million; design and construction of two large corporate jet aircraft hangars; and for the hydrocarbon recovery program to include investigation, analysis, design of recovery systems, monitoring of recovery systems, and planning and design of residual recovery systems utilizing biodegradation. Participated, as sub-consultant, in Air Force IRP seminar.

HNTB (1979-1981): Airport Engineer

Responsibilities included development of master plan for Iowa Air National Guard base; project initiation assistance for a new regional airport in Florida; engineering assistance for new facilities design and construction for Maryland Air National Guard; master plan for city maintenance facilities, Orlando, Florida; in-country master plan and preliminary engineering project management for Madrid, Spain, International Airport; and project management of master plan for Whiting Naval Air Station and outlying fields in Florida.

HNTB (1974-1979): Design Engineer

Responsibilities included development of feasibility and site selection studies for reliever airports in Cleveland and Atlanta; site selection and facilities requirements for the Office of Aeronautical Charting and Cartography, NOAA; and onsite mechanical and electrical engineering design for terminal improvements at Baltimore-Washington International Airport, Maryland.

HNTB (1972-1974): Airport Engineer

Responsible for development of portions of the master plan and preliminary engineering for a new international airport for Lisbon, Portugal, estimated to cost \$250 million.

Self-employed (1971-1972): Private Consultant

Responsible for engineering planning and installation of a production line for multimillion-dollar contract in Madrid, Spain, to fabricate transmissions and differentials for U.S. Army vehicles.

U.S. Army, Corps of Engineers (1969-1971): Chief, Materiel & Programs

Directed materiel planning and military training programs of military assistance to the Spanish Army. Controlled arrival and acceptance of materiel by host government. Served as liaison/advisor to American industry interested

in conducting business with Spanish government. Was Engineer Advisor to Spanish Army Construction, Armament and Combat Engineers, also the Engineer Academy and Engineer School of Application.

Corps of Engineers (1968-1969): Chief, R&D Branch, OCE

Directed office responsible to Chief of Engineers for research and development. Developed research studies in new concepts of bridging, new explosives, family of construction equipment, night vision equipment, expedient airfield surfacing, expedient aircraft fueling systems, water purification equipment and policies, prefabricated buildings, etc. Achieved Department of Army acceptance for development and testing of new floating bridge. Participated in high-level Department Committee charged with development of a Tactical Gap Crossing Capability Model.

Corps of Engineers (1967-1968): Division Engineer

Facilities engineer in Korea. Was fully responsible for management and maintenance of 96 compounds within 245 square miles including 6,000+ buildings, 1 million linear feet of electrical distribution lines, 18 water purification and distribution systems, sanitary sewage disposal systems, roads, bridges, and fire protection facilities with real property value of more than \$256 million. Planned and developed the first five-year master plan for this area. Administered \$12 million budget and \$2 million engineer supply operation. Was in responsible charge of over 500 persons. Developed and obtained approval for additional projects worth \$9 million for essential maintenance and repair. Directed cost reduction programs that produced more than \$500,000 savings to the United States in the first year.

Corps of Engineers (1963-1967): Engineer Advisor

Engineer and aviation advisor to the Spanish Army. Developed major modernization program for Spanish Army Engineers, including programming of modern engineer and mobile maintenance equipment. Directed U.S. portion of construction, testing and acceptance of six powder plants, one shell loading facility, an Engineer School of Application, and depot rebuild facilities for engineer, artillery, and armor equipment. Planned and developed organization of a helicopter battalion for the Spanish Army. Responsible for sales, delivery, assembly and testing of 12 new helicopters in country. Provided U.S. assistance to unit until self-sufficiency was achieved. Was U.S. advisor to Engineer Academy, School of Application and Polytechnic Institute.

Corps of Engineers (1960-1963): Deputy District Engineer

Responsible for planning and development of extensive construction projects in the Ohio River Basin for flood control and canalization, including dam, lock, bridge, and building construction, highway relocation, watershed studies, real estate acquisitions and dispositions. Was contracting officer for more than \$75

million of projects per year. Supervised approximately 1,300 personnel, including 300 engineers. Planned and directed cost reduction programs amounting to more than \$200,000 per year. Programmed and controlled development of a modern radio and control net in a four-state area.

Corps of Engineers (1959-1960): Area Engineer

Directed construction of a large airfield in Ohio as Contracting Officer's representative. Assured that all construction (runway, steam power plant, fuel transfer and loading facilities, utilities, buildings, etc.) complied with terms of plans and specifications. Was onsite liaison between Air Force and contractors.

Corps of Engineers (1958-1959): Chief, Supply Branch

Managed engineer supply yard containing over \$21 million construction supplies and engineer equipment. Directed in-storage maintenance, processing and deprocessing of equipment. Achieved complete survey of items on hand, a new locator system and complete rewarehousing, resulting in approximately \$159,000 savings in the first year.

Corps of Engineers (1957-1958): Student

U.S. Army Engineer School, Engineer Officer's Advanced Course.

Corps of Engineers (1954-1957): Engineer Manager

Managed engineer construction projects and was assigned to staff and faculty of the Engineer School. Was in charge of instruction on engineer equipment utilization, management and maintenance. Directed Electronic Section of the school. Coordinated preparation of five-year master plan for the Department of Mechanical and Technical Equipment.

Corps of Engineers (1949-1954): Engineer Commander

Positions of minor but increasing importance and responsibility in engineering management, communications, demolitions, construction administration and logistics.

PROFESSIONAL AFFILIATIONS

Member, National Society of Professional Engineers  
Fellow, Society of American Military Engineers  
Member, American Society of Civil Engineers  
Member, Virginia Engineering Society  
Member, Project Management Institute

**APPENDIX B**  
**OUTSIDE AGENCY CONTACT LIST**

## OUTSIDE AGENCY CONTACT LIST

Alaskan Department of Environmental Conservation  
3601 C Street, Suite 1350  
Anchorage, AK 99508  
Bruce Erickson and James Hayden, (907) 563-6529

Arctic Environmental Information and Data Center  
University of Alaska  
707 A Street  
Anchorage, AK 99501  
(907) 257-2733

National Oceanic and Atmospheric Administration  
Office of Hydrology  
Grammax Building  
8060 13th Street  
Silver Spring, MD 20910  
(301) 427-7543

National Oceanic and Atmospheric Administration  
701 C Street, Box 38  
Anchorage, AK 99513  
(907) 271-5040

State of Alaska Department of Natural Resources  
Division of Geological and Geophysical Surveys  
3700 Airport Way  
Fairbanks, AK 99709-4609  
Mark Robinson (907) 474-7147

U.S. Fish and Wildlife Services  
1011 East Tudor Road  
Anchorage, AK  
Ronald Garrett, (907) 786-3435

U.S. Fish and Wildlife Service  
1412 Airport Way  
Fairbanks, AK 99701-8524  
R.E. (Skip) Ambrose, (907) 456-0239

U.S. Geological Survey  
12201 Sunrise Valley Drive  
Reston, VA 22092

U.S. Geological Survey  
4200 University Drive  
Anchorage, AK 99508  
Oscar J. Ferrians, Jr., (907) 561-1181

U.S. Soil Conservation Service  
201 East 9th Avenue, Suite 300  
Anchorage, AK  
(907) 271-2424

**APPENDIX C**  
**USAF HAZARD ASSESSMENT RATING METHODOLOGY**  
**AND GUIDELINES**

## USAF HAZARD ASSESSMENT RATING METHODOLOGY

The Department of Defense (DoD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DoD facilities. One of the actions required under this program is to:

develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Preliminary Assessment phase of its Installation Restoration Program (IRP).

### PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air National Guard in setting priorities for follow-on site investigations.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

### DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DoD program needs.



The model uses data readily obtained during the Preliminary Assessment portion of the IRP. Scoring judgment and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards. This approach meshes well with the policy for evaluating and setting restrictions on excess DoD properties.

Site scores are developed using the appropriate ranking factors according to the method presented in the flow chart (Figure 1 of this report). The site rating form and the rating factor guideline are provided at the end of this appendix.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: possible receptors of the contamination, the waste and its characteristics, the potential pathways for contaminant migration, and any efforts that were made to contain the wastes resulting from a spill.

The receptors category rating is based on four rating factors: the potential for human exposure to the site, the potential for human ingestion of contaminants should underlying aquifers be polluted, the current and anticipated uses of the surrounding area, and the potential for adverse effects upon important biological resources and fragile natural settings. The potential for human exposure is evaluated on the basis of the total population within 1,000 feet of the site, and the distance between the site the the base boundary. The potential for human ingestion of contaminants is based on the distance between the site and the nearest well, the groundwater use of the uppermost aquifer, and population served by the groundwater supply within 3 miles of the site. The uses of the surrounding area are determined by the zoning within a 1-mile radius. Determination of whether or not critical environments exist within a 1-mile radius of the site predicts the potential for adverse effects from the site upon important biological resources and fragile natural settings. Each rating factor is numerically evaluated (0-3) and increased by a multiplier. The maximum possible score is also computed. The factor score and maximum possible scores are totaled, and the receptors subscore computed as follows: receptors subscore =  $(100 \times \text{factor score subtotal} / \text{maximum score subtotal})$ .

The waste characteristics category is scored in three stages. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways: surface-water migration, flooding, and groundwater migration. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned, and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among the three possible routes is used. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The scores for each of the three categories are added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Scores for sites with no containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

# HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

## 1. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels			Multiplier
	0	1	2	
A. Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	10
C. Land Use/Zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	6
E. Critical environments (within 1-mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; protected areas; presence or economically important natural resources susceptible to contamination	10
F. Water quality/use designation of nearest surface water body	Agricultural or Industrial use	Recreation, propagation and management of fish and wildlife	Shellfish propagation and harvesting	6
G. Ground-water use of uppermost aquifer	Not used, other sources readily available	Commercial, Industrial, or irrigation, very limited other water sources	Drinking water, municipal water available	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1-50	51-1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	6

## 11. WASTE CHARACTERISTICS

### A-1 Hazardous Waste Quantity

- S = Small quantity (5 tons or 20 drums of liquid)
- M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
- L = Large quantity (20 tons or 85 drums of liquid)

### A-2 Confidence Level of Information

- C = Confirmed confidence level (minimum criteria below)
- o Verbal reports from interviewer (at least 2) or written information from the records
- S = Suspected confidence level
- o No verbal reports or conflicting verbal reports and no written information from the records

- o Knowledge of types and quantities of wastes generated by shops and other areas on base
- Logic based on the knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site

### A-3 Hazard Rating

Rating Factors	Rating Scale Levels		
	0	1	2
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2
Ignitability	Flash point greater than 200° F	Flash point at 140° F to 200° F	Flash point less than 80° F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels
			Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

# 11. WASTE CHARACTERISTICS - Continued

## Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
	L	C	M
80	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
	L	S	M
50	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	M
20	S	S	L

## Notes:

For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

## Confidence Level

- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

## Waste Hazard Rating

- o Wastes with the same hazard rating can be added.
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

## B. Persistence Multiplier for Point Rating

Multiply Point Rating Persistence Criteria	From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4
<u>Physical State Multiplier</u>	
<u>Physical State</u>	Multiply Point Total from Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

## C. Physical State Multiplier

# 111. PATHWAYS CATEGORY

## A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

## B-1 Potential for Surface Water Contamination

Rating Factors	Rating Scale Levels				Multiplier
	0	1	2	3	
Distance to nearest surface water (including drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay (>10 <sup>-2</sup> cm/sec)	15% to 30% clay (10 <sup>-2</sup> to 10 <sup>-4</sup> cm/sec)	30% to 50% clay (10 <sup>-4</sup> to 10 <sup>-6</sup> cm/sec)	Greater than 50% clay (<10 <sup>-6</sup> cm/sec)	6
Rainfall intensity based on 1-year 24-hour rainfall (Number of thunderstorms)	<1.0 inch (0-5)	1.0 to 2.0 inches (6-35)	2.1 to 3.0 inches (36-49)	>3.0 inches (>50)	8

## B-2 Potential for Flooding

Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1
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## B-3 Potential for Ground Water Contamination

Depth to groundwater	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	8
Soil permeability	Greater than 50% clay (<10 <sup>-6</sup> cm/sec)	30% to 50% clay (10 <sup>-4</sup> to 10 <sup>-6</sup> cm/sec)	15% to 30% clay (10 <sup>-2</sup> to 10 <sup>-4</sup> cm/sec)	0% to 15% clay (>10 <sup>-2</sup> cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground water level	8

### B-3 Potential for Ground Water Contamination - Continued

Rating Factors	Rating Scale Levels			Multiplier
	0	1	2	

Direct access to groundwater (through faults, fractures, faulty well casings, subsidence, fissures, etc.)

No evidence of risk

Low risk

Moderate risk

High risk

0

#### IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

#### B. Waste Management Practices Factor

The following multipliers are then applied to the total risk points (from A):

##### Waste Management Practice

No containment  
Limited containment  
Fully contained and in full compliance

##### Multiplier

1.0  
0.95  
0.10

Guidelines for fully contained:

##### Landfills:

o Clay cap or other impermeable cover  
o Leachate collection system  
o Liners in good condition  
o Adequate monitoring wells

##### Surface Impoundments:

o Liners in good condition  
o Sound dikes and adequate freeboard  
o Adequate monitoring wells

##### Spills:

o Quick spill cleanup action taken  
o Contaminated soil removed  
o Soil and/or water samples confirm total cleanup of the spill

##### Fire Protection Training Areas:

o Concrete surface and berms  
o Oil/water separator for pretreatment of runoff  
o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1, or III 6-3, then leave blank for calculation of factor score and maximum possible score.

**APPENDIX D**


**FINDING OF NO SIGNIFICANT CONTAMINATION AND PCB CLEARANCE CERTIFICATE**



Finding of No Significant Contamination

CANYON CREEK RADIO RELAY SITE

This excess real property contains no known contamination as specified by Resource Conservation and Recovery Act of 1976 (RCRA); as amended, the Toxic Substance Control Act of 1976, the Comprehensive Environmental Response, Compensation and Liability Act of 1980, the implementing Environmental Protection Agency, federal regulations (40 CFR 261, 262, 263, and 761), and the Federal Property Management Regulations (41 CFR 101).



JAMES W. HOSTMAN

Chief, Environmental Planning Division, AAC  
Chairperson/MAJCOM Environmental Protection Committee

Description of Site:

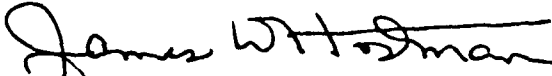
Parcelsof land to be excessed is in Section 15, Township 7 South, Range 6 East, Fairbanks meridian.

The excess area is more specifically described at TAB-A of the Declaration of Excess.

PCB Clearance Certificate

CANYON CREEK RADIO RELAY SITE

This is to certify that a records search and an on-site inspection indicate that this property has not been exposed to PCB materials or equipment.



JAMES W. HOSTMAN  
Chief, Environmental Planning Division, AAC  
Chairperson/MAJCOM Environmental Protection Committee

Description of Site:

Parcels of land to be excessed is in Section 15, Township 7 South, Range 6 East, Fairbanks meridian.

The excess area is more specifically described at TAB-A of the Declaration of Excess.

**APPENDIX E**  
**PHOTOGRAPHS**

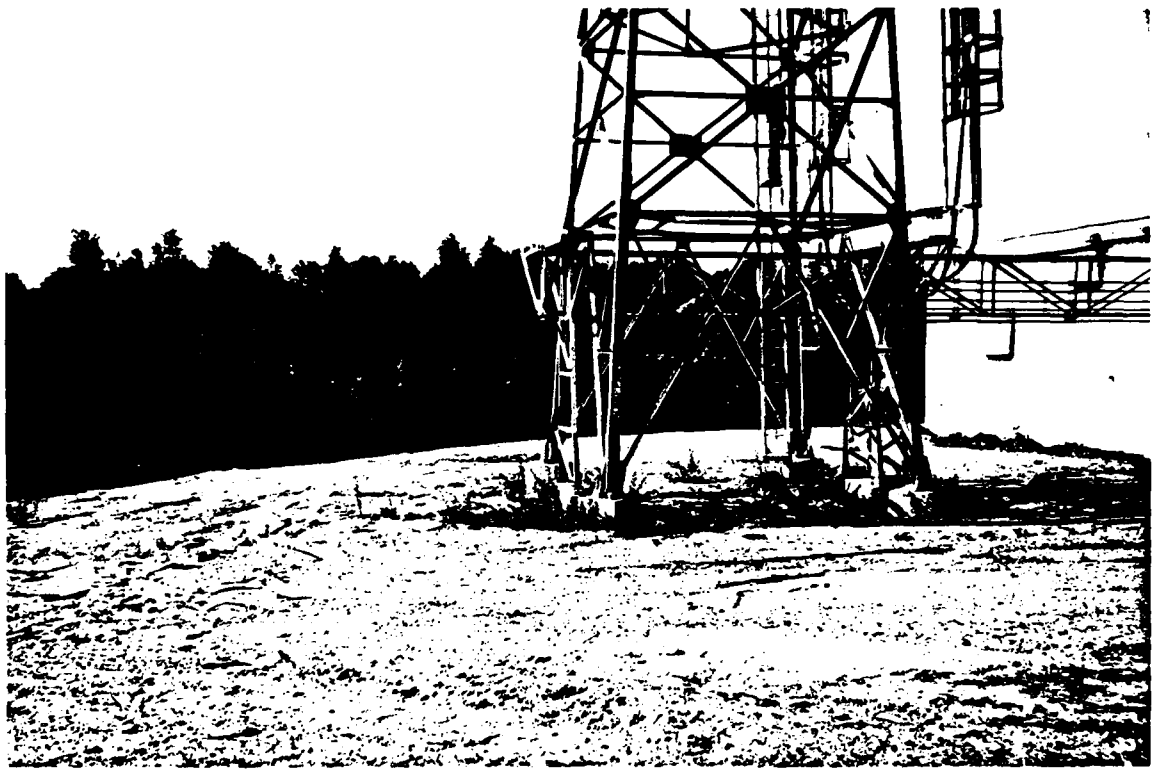


Photo 1. Recently graded soil at Canyon Creek RRS.

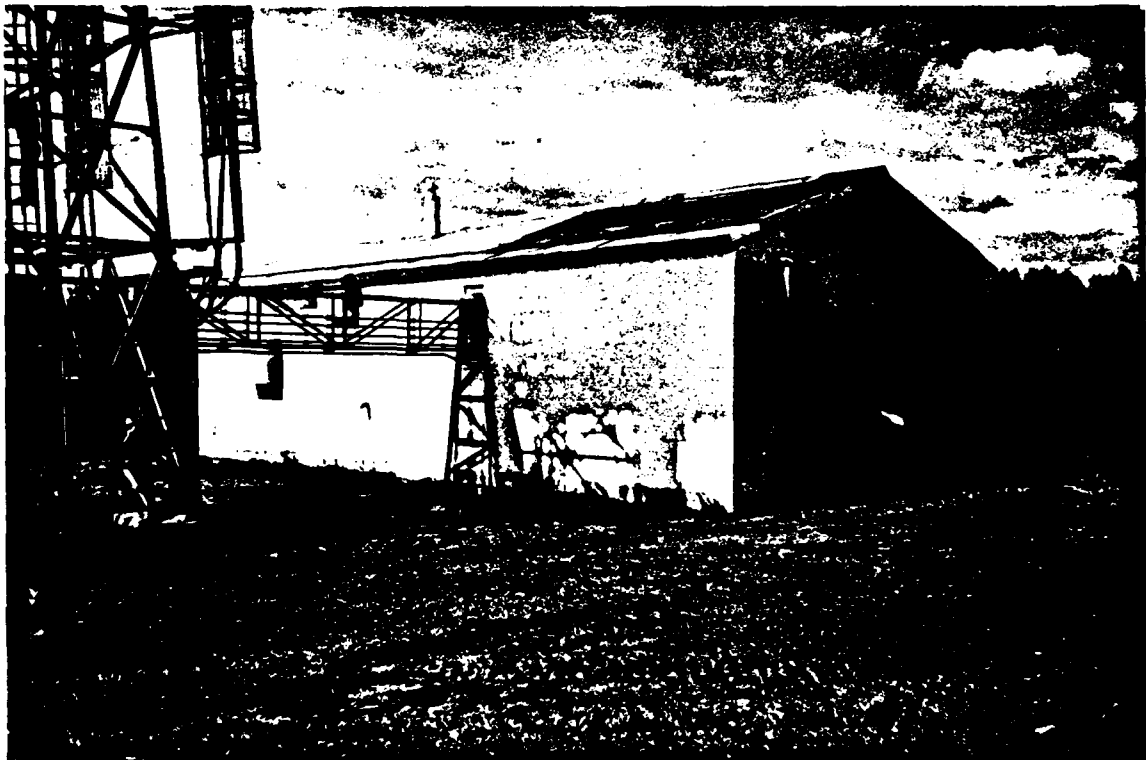


Photo 2. Radio relay building and tower.



Photo 3. Location of abandoned underground storage tanks.



Photo 4. Digging to expose underground storage tank.